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Key challenges of system dynamics implementation in project management

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Abstract

System dynamics can fail to make an impact in projects, particularly due to challenges in the implementation phase. Ensuring successful implementation is therefore essential. This can be done by first identifying the implementation challenges. By conducting expert validation sessions, this paper suggests that the challenges are due to lack of understanding and trust in the model itself. Eleven root causes of these challenges are identified by applying Ishikawa's fishbone method. They can be categorized into three main categories: mental model shifting, engaging stakeholders and leading changes, and explaining and credibly implementing the model. These are all related with managing people.

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1. Introduction

The most decisive yet challenging factor of System Dynamics (SD) application in project management (PM) is how project managers successfully implement an SD model output in their projects. Repenning and Sterman (2002) describe two case studies where SD successful application relies on the effectiveness of its implementation stage (i.e. how the model output should be grasped by the decision makers and disseminated). Similarly, Größler (2007) analyzes two case studies where SD projects failed to make an impact. He concludes that even a well-built SD model may provide little or even no impact when it is not properly implemented due to lack of key project stakeholders'

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involvement. Größler's (2007) finding supports Forrester's (1994) statement in which many SD projects failed to reach their potential due to their failure to gain necessary support. However, Größler's (2007) work does not further analyze the root causes which underpin project stakeholders' lack of involvement the implementation phase.

This research, therefore, continues Größler's (2007) work. It aims to ensure successful implementation of SD in PM by identifying the root causes and therefore the main challenges. This is done by applying a 'root causes identification' method called the Fishbone diagram, which was first developed by Kaoru Ishikawa in a quality management context (Wong, 2011). Based on the root causes, the main implementation challenges are proposed.

2. Literature Review

Project management (PM) is essential because all organizations, either small or large, are involved in the application of new undertakings (Camilleri, 2011). Most projects, however, are underperformed. For instance, Reichelt's and Lyneis' (1999) work shows that in a sample of 10 large, complex development projects (i.e. aerospace, shipbuilding and civil construction projects) the average budget overrun was 86 per cent, and schedule overrun was 55 per cent. Lyneis, Cooper, and Els (2001) argues that one major reason underlying this is that most PM methods and concepts view projects partially, while they are actually complex systems. This is perfectly illustrated in Repenning's and Sterman's (2001) statement: "[...] it's not just a tool problem, any more than it's a human resources problem or a leadership problem. Instead it is a systemic problem that is created by the interaction of tools, equipment, workers and managers." Consequently, there is a need for an approach that is able to model this complex and systemic problem, which is what 'System Dynamics' (SD) is (Sterman, 2002).

One area where SD has been most successfully applied is project management (Lyneis et al., 2001). There are many stories of SD successful application in PM. Godlewski, Lee, and Cooper (2012), for instance, claim that SD helps a large construction company called Fluor Corporation (Fluor) to gain business benefit of more than \$800 million since 2005. Another example is Litton Industries, Inc. (Litton) whose benefit is estimated between \$170-350 million from the use of SD (Cooper, 1980). Although SD application in PM is perceived as successful, a relatively small percentage of projects have used SD (Lyneis and Ford, 2007). Lyneis and Ford (2007) propose three approaches to increase SD application in PM:

- Publishing more success stories, particularly in PM literature
- Making SD models easier and less expensive to develop
- Attempting to better integrate SD models with traditional PM tools

In addition, ensuring its successful application is also liable to increase SD applications in PM. Based on marketing's post-purchase actions theory (Kotler, 2000), if customers (or in this case, project managers) are satisfied (i.e. if SD success in their projects is ensured) they will tend to use it again (thus making SD application sustainable) and promote it to their colleagues (thus increasing the use of SD in PM). Adding to this, since some SD projects failed to make an impact (Größler, 2007), ensuring SD successful implementation is crucial. This cannot be done without identifying the main challenges of SD implementation in PM, which is the focus of this research.

3. Method

3.1. Expert validation sessions: purposes and definitions

Assimilating both theoretical and practical views is a crucial issue in this research. To do this, the authors applied a method called Expert Validation Sessions (EVS) where theoretical information from the literature is validated by a review panel or experts as in the systematic review method (Tranfield, Denyer, & Smart, 2003). However, there are some issues which are not discussed yet in the literature, thus the role of experts in this particular case is more to give insights and to share their experiences rather than to validate the literature.

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